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ABSTRACT

The purpose of this paper is to report on the various formative evaluation activities that have been conducted for the Masters of Science in Agronomy Distance Education Program at Iowa State University and to provide useful recommendations for educators involved in World Wide Web-based course development. It was found that those faculty members having experiences with distance education held more positive perceptions toward Web-based instruction. Students believed they were learning as much in the distant environment as they would on campus. They liked the interactive multimedia activities and asked for clear structure for navigation in each Web page. As results of the evaluations, lesson maps, examples of the calculations, glossaries, search, and more multimedia presentations have been added to the courses. (Author/MES)

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Formative Evaluations of a Web-based Masters Program: Insights for Web-based Course Developers

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Abstract: The purpose of this paper is to report the various formative evaluation activities that have been conducted for the Masters of Science in Agronomy Distance Education Program at Iowa State University and to provide useful recommendations for educators involved in Web-based course development. It was found that those faculty members having experiences with distance education held more positive perceptions toward Web-based instruction. Students believed they were learning as much in the distant environment as they would on campus. They liked the interactive multimedia activities and asked for clear structure for navigation in each web page. As results of the evaluations, lesson maps, examples of the calculations, glossaries, search, and more multimedia presentations have been added to the courses.

Introduction

Distance education has a long history of applying technologies in delivering instruction to those who are not able to participate in a campus-based curriculum. Many people involved in distance education are professional individuals who are seeking to pursue advanced degrees and empower themselves with knowledge that is relevant to their career field (Butler, 1996). The latest in the long line of instructional technologies is the World Wide Web (WWW). The World Lecture Hall listed almost 800 Web-based courses that were delivered by higher educational institutions, and this list had been growing daily (World Lecture Hall, 1999).

In the fall of 1998, the Masters of Science in Agronomy Distance Education Program at Iowa State University (ISU) started providing interactive multimedia courses in which most course materials and resources were accessed and delivered through the WWW and CD-ROM (Iowa State University, 1999). One of the goals of this program was to provide a way for professionals working in industry and the government to gain an advanced degree in Agronomy without having to attend the campus in person. The curriculum consists of 12 courses, a 1-credit workshop, and a 3-credit creative component, which totals 30 semester credits (Howard, 1999). The courseware integrates content material on CD-ROM with the interactive tools of WebCT (WebCT, 1999) on an ISU server. The WebCT tools allow students to interact electronically with their instructors and classmates by utilizing a course calendar, discussion board, chat room, student homepages, and group project organization, etc. The program began with an enrollment of fifteen students in a pilot program in the 98/99 academic year. Currently forty-two students are enrolled in the program.

At the initial development stage of the Master of Science in Agronomy Distance Education Program at ISU, conducting formative evaluations is needed to obtain more understanding and knowledge about Web-based learning/teaching and to improve and strengthen the program. The purpose of this paper is to report the various formative evaluation activities that have been conducted for the Masters of Science in Agronomy Distance Education Program, the results of evaluations, actions taken to improve the courses, and to provide useful recommendations for others involved in Web-based course development.

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Evaluations

Formative evaluations have been conducted along with the course development of the Masters of Science in Agronomy Distance Education Program at ISU. Faculty members and students were the primary audience of the evaluations.

Faculty

Agronomy faculty members at Iowa State University were surveyed regarding their perceptions of the Masters of Science in Agronomy Distance Education Program in the spring of 1998 (Born and Miller, 1999). Findings showed that those faculty members having experiences with distance education held more positive perceptions toward Web-based instruction than those not having experiences. Table 1 shows the comparison of faculty perceptions by whether or not they were involved in other distance courses, familiarity of the M.S. in Agronomy Degree Program, whether or not they were involved in the M.S. in Agronomy Degree Program, and whether or not they have viewed a M. S. in Agronomy degree program lesson. Faculty perceptions were significantly positive if the faculty were familiar with the Agronomy Distance Education Program, and had viewed a lesson developed by the M. S. in Agronomy degree program. Faculty members were the most positive about the comparability between Web-based and on-campus courses in regard to challenge. They also thought the university should develop more Web-based courses and integrate them into the curricula (Table 2).

Furthermore, informal comments regarding the on-line course development were collected from the instructors involved in the program. Faculty revealed that developing and managing the on-line courses required them to have a larger amount of time commitment than traditional courses. For example, one instructor indicated that to interact with the students, she averaged half an hour per week for one student.

Table 1. A comparison of faculty perception of Web-based distance education and M. S. in Agronomy degree program by selected variables (n = 36)[a]

Variable	Overall Perception of Web-based Distance Education			Perception of the M.S. in Agronomy Degree Program		
	Mean[b]	SD	t-value	Mean[b]	SD	t-value
Whether involved in other distance education courses						
No	3.38	0.61	-1.4	3.03	0.55	-2.47*
Yes	3.70	0.66		3.53	0.57	
Whether familiar with the M.S. in Agronomy degree program						
No	3.30	0.61	-2.15*	2.93	0.54	-3.35*
Yes	3.70	0.61		3.50	0.52	
Whether involved in the M.S. in Agronomy degree program						
No	3.36	0.59	-1.23	2.99	0.50	-2.27*
Yes	3.60	0.68		3.34	0.65	
Whether viewed a M.S. in Agronomy degree program lesson						
No	3.22	0.60	-3.41*	2.88	0.46	-4.52*
Yes	3.83	0.49		3.58	0.52	

[a] Adapted from Born and Miller (1999)

[b] 1 = strongly disagree, 2 = disagree, 3 = undecided, 4 = agree, 5 = strongly agree

* $p < .05$

Table 2. Means and standard deviations for faculty perceptions of Web-based distance education and the M.S. in Agronomy Distance Education Degree Program (n = 36)[a]

Statement	Mean[b]	SD
Overall perception of Web-based DE.	**3.46**	**0.63**
Web-based, distance education courses can be as challenging as on-campus courses.	4.00	0.92
Web-based, distance education courses should become an integrated part of university curricula.	3.98	0.75
Our department needs to develop more Web-based, distance education courses.	3.67	0.93
If I were a student, I would consider enrolling in a Web-based, distance education course or program.	3.50	0.89
Web-based, distance education courses are as academically challenging as on-campus courses.	3.43	0.91
Web-based, distance education courses should be offered as substitutes for some on-campus courses.	3.38	1.03
Web-based, distance education courses can not be as effective as on-campus courses.	3.33[c]	1.14
Students spend less time working on Web-based, distance education courses than on-campus courses.	3.33[c]	0.61
I would consider teaching a Web-based, distance education course.	3.31	1.07
Teaching a distance education course would improve my on-campus teaching.	3.31	1.05
Effective student-professor interaction is not possible in Web-based, distance education courses.	3.26[c]	0.96
On-line degrees should not be valued as equivalent to on-campus degrees in the job market.	2.98[c]	1.14
Perception of the M.S. in Agronomy Degree Program.	**3.15**	**0.59**
The time and effort expended on the Master of Science in Agronomy Distance Education Degree Program is not appropriate.	3.27[c]	0.59
A Master of Science in Agronomy Distance Education Degree Program will be perceived by employers as having similar status or value as compared to an on-campus Master of Science degree.	3.10	0.77
The Master of Science in Agronomy Distance Education Degree Program is as rigorous as an on-campus Master of Science Degree Program.	3.10	0.94

[a] Developed by Born and Miller (1999)
[b] 1 = strongly disagree, 2 = disagree, 3 = undecided, 4 = agree, 5 = strongly agree
[c] Indicates negatively worded items that were reverse coded.

Students

In addition to seeking for faculty's opinions regarding the program, students were also asked to evaluate the Web-based courses developed by the program. One pre-pilot focus group study included interviews with the students after they previewed the lessons in August of 1998 (Singh, 1999). It was found that in general the students liked the lessons and they discovered the lessons were better than what they had expected. They thought that they were learning as much in the distance environment as they would on campus. The students said that the interactive exercises made the lessons interesting and helped them in understanding the concepts. Many of the students also said that more interactive exercises should be included in the lessons. They expressed that it would be helpful to have access to the Glossary at all times, not just from specific words in the lessons. Most of them were a little confused about their location

within a lesson so they suggested that it would be helpful to have a lesson map to the headings and subheadings within the lessons. Another suggestion was to have a list of study questions and assignments so that the students could be sure that they had not missed any question or assignment. The students liked the multimedia presentations and the ease of playing them. They suggested that audio should be added. Moreover, all the students agreed that the lessons should help them in making the connection between theory and its practical application. They also appreciated the opportunity to access a higher education degree program and the efforts made in conducting the pilot evaluation for the lesson improvement.

Students completed a questionnaire regarding their perceptions of Web-based distance education and the M.S. in Agronomy Distance Education Degree Program in the fall of 1998. Students agreed that the computer they used for the program was sufficient for course materials and they were satisfied with the technical supports they received (Table 3). They also believed that they had appropriate computer skills when they began their work in the M.S. in Agronomy program. They thought that the M.S. degree in Agronomy Distance Education Program should be of equal value to a traditional on-campus degree. They agreed that they would not be able to work on their Masters if it were not for this distance degree in Agronomy. They also agreed that they preferred distance courses to on-campus courses.

Students taking the courses offered in the fall of 1998 and spring of 1999 completed a survey questionnaire regarding various aspects of the courses. Overall, students agreed that the courses stimulated their interest in the subject matter. They thought their understanding of the subject has increased because of their experiences in taking the courses. They thought that the images and animations helped them in understanding and visualizing the lesson content and the course content was relevant to their career goals. In addition, they indicated that audio and video should be incorporated more often in explaining the concepts. They did not think that the navigation through the lessons was clear and logical or there was adequate explanation for all the acronyms and Greek symbols used within the lessons.

In the fall of 1999, one student in each course was asked to evaluate individual lesson weekly. Three questions were asked in the weekly lesson evaluation. The first question was: "What were the most effective parts of the lesson for you?" Up to the date of writing this paper, most of the students responded that the most effective part of the lessons were the multimedia presentations of concepts. They also reported that the lessons effectively used maps, charts, and tables to back up the text and the lesson materials were well organized. Students liked the use of features such as FYI, In Detail, Study Questions, and Glossary to supplement information presented while maintaining the flow of material. The hands on activities went with these interactive features "are the best learning" according to one student. The second question was: "What did you like least about the content and/or design of this lesson?" Some students replied that they did not like those lessons which were extremely too long for a week. One student revealed that he did not like the activities that required him to be on-line because he needed to be able to be in a motel, at home, or at some other site to study whenever possible. One student was frustrated to work on the symbols of the math or equations from MS Word for the assignment. Technical problems are always not patiently welcome. However, only one student reported having technical problems. The problem was that the animations did not work properly even though he had downloaded all the plug-ins required. One student had problems with exams. He said that he would like to know what is expected and what concepts were deemed to be important for the exams. Regarding what could be added to the lessons to enhance student learning, students would like to see more multimedia presentations to help convey conceptual topics more effectively and more real pictures as real world examples. One student suggested to add an appendix with a review, problems, or recommended supplemental text that will be important to study the subject matter. Another student would like to see some case studies where the modeling concepts were applied.

Actions of Improvement

Based on the results of these evaluations, improvements have been made. For example, lesson maps, examples of the calculations, and glossaries have been added to the courses. More multimedia presentations have been developed. Navigation has been improved by adding back to the previous lesson

and to the immediate following lesson. A search function for topics and words within each course has also been tested.

Table 3. Means and standard deviations for student perceptions of Web-based distance education and the M.S. in Agronomy Distance Education Degree Program (n = 11)[a]

Statement	Mean[b]	SD
Logistics	**3.15**	**0.86**
The computer I used for the program was sufficient for course materials.	3.64	0.50
Questions on technical problems were answered quickly and efficiently by the MS in Agronomy staff.	3.55	0.69
I felt comfortable with the computer systems and software.	3.27	1.19
The instructions that were provided to help set-up my computer for the program were effective.	3.09	0.94
I was given an adequate amount of time to become comfortable with the technology before I was required to participate.	3.00	1.18
The number of on-campus meetings was adequate.	2.91	1.14
Correspondence was answered by the instructor within two business days of receipt.	2.73	1.49
The library was available for research.	2.30	0.48
Research and reference materials were accessible.	2.30	0.48
If this course had not been offered via distance learning, I would have commuted to ISU to take a similar course.	.33[c]	0.50
Computer Skills	**2.49**	**0.89**
I had the appropriate computer skills when I began my work in the MS in Agronomy program.	3.18	1.25
Students should be informed about the level of computer skills necessary for the classes prior to enrolling in the program.	2.91	0.54
As a result of my work in the program, my computer skills have improved.	2.55	0.69
I needed more experience working with Excel for my work in the program.	2.45	0.93
I needed more experience working with the Internet for my work in the program.	1.36	1.03
Time and Convenience	**2.70**	**0.98**
This degree should be of equal value to a traditional on-campus degree.	3.45	0.93
I would not be able to work on my Masters if it were not for this distance degree.	3.27	0.90
I prefer distance courses to on-campus courses.	3.09	0.94
I never felt that the technical problems of this course were overwhelming.	2.36	1.12
The classes should adhere to the traditional semester scheduling.	2.36	1.12
I spent more time per week on the distance classes than I would have in a traditional graduate course taught on campus.	2.27	0.79
The amount of time spent on each class was consistent from week to week.	2.09	1.04

[a] Developed by Singh (1999)
[b] 1 = strongly disagree, 2 = disagree, 3 = undecided, 4 = agree, 5 = strongly agree
[c] Indicates negatively worded items that were reverse coded.

Conclusions and Recommendations

Based on the results of these on-going formative evaluations, the following conclusions were drawn:

- Those faculty members having experiences with distance education and the M. S. in Agronomy degree program held more positive perceptions toward Web-based instruction.
- Faculty recognized that more time commitment was needed to develop and manage the Web-based courses than traditional ones.
- Students were positive about interactive multimedia activities.
- Students wanted clear structure for navigation in each web page.
- Students believed they were learning as much in the distant environment as they would on campus.
- Students appreciated the access to a higher education degree program provided.
- Students also appreciated the efforts made in conducting the evaluations for the improvement of the lessons.

Recommendations were made for educators who are interested in Web-based course development as follows:

- Opportunities should be provided for faculty members to be involved with Web-based education to ensure the acceptance and adoption of the distance program.
- More interactive multimedia activities should be included in the Web-based lessons.
- Developers should make navigation of the lesson pages as simple and clean as possible.
- Distance education degree programs should be provided.
- On-going formative evaluations are needed to obtain evidence to help with the design of the Web-based courses and continue to improve the quality of the courses.

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